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52. (New) The integrated circuit semiconductor device as recited in claim 38 wherein said primary protective layer has a thickness less that approximately 20% of a thickness of said flowable oxide insulator layer.

REMARKS

Claims 27 - 33 and 36 - 48 remain active in this application. Claims 27 and 38 have been amended to improve form and clarity. New claims 49 - 52 have been added. Support for the amendments of the claims is found throughout the application, particularly at pages 11 - 12. No new matter has been introduced into the application.

Claims 27, 31 - 33, 36 - 41 and 43 - 46 have again been rejected under 35 U.S.C. §102 as being anticipated by Kawanoue et al., claim 28 has again been rejected under 35 U.S.C. §103 as being unpatentable over Kawanoue et al. in view of Lopatin et al., claims 29 - 30 have again been rejected under 35 U.S.C. §103 as being unpatentable over Kawanoue et al. in view of Lopatin et al and Yew et al. and claims 42 and 47 - 48 have again been rejected under 35 U.S.C. §103 as being unpatentable over Kawanoue et al. in view of Usami; the Examiner indicating that previous remarks are non-persuasive since silicon dioxide can be made to flow at a temperature above the melting point thereof. All of these grounds of rejection are respectfully traversed, particularly as being moot in view of the amendments made above.

Specifically, all of the stated grounds of rejection rely on a particular construction of the Kawanoue et al. reference and the Examiner's contention that layer 161 is a flowable oxide and that layer 163 is an oxidized surface thereof. It is respectfully submitted that neither of these assertions is true, as can be readily determined from Kawanoue et al. As

pointed out on page 2, in the "Background" section of the present application, flowable oxide materials are a recognized family of low dielectric constant materials. These materials are believed to have a structure in which bridging oxygen atoms are shared between molecules. Further, it is indicated on at least page 12 of the present application that the dielectric constant of flowable oxide materials is increased when the flowable oxide material is oxidized. U. S. Patent 5,530,293, cited on page 12 of the present application also documents the dielectric constant of SiO_2 to be 4 while a flowable oxide, (also referred to as a SiO_2 precursor) exhibits a dielectric constant of 3.2 or less.

In contrast, as pointed out in the previous response, insulator 161 of Kawanoue et al. is silicon oxide (column 20, line 21) which is ordinarily understood in the art to refer to SiO_2 which is not deficient in oxygen and thus cannot be further oxidized as is claimed in order to form the primary protective layer but, in fact, is explicitly disclosed to be chemically *reduced* along the interface with deposited tantalum nitride (TaN_x) while the deposited tantalum nitride is oxidized (column 20, lines 37 - 41). Therefore, the Examiner is clearly incorrect in characterizing silicon oxide as a flowable oxide and has not made a *prima facie* demonstration of obviousness of any claim in the application since the primary protective layer is not formed of the material claimed (an oxidized surface layer of the flowable oxide) and cannot make such a demonstration since silicon oxide cannot be further oxidized, as claimed, to form the primary protective layer of flowable oxide, a SiO_2 precursor. Further, the Examiner's conclusions clearly contradict *both* the present disclosure which clearly and explicitly defines the class of materials known in the art as flowable oxides and the principal reference

relied upon which explicitly states that the silicon oxide is *reduced* rather than *oxidized* at the interface with tantalum nitride.

It is also respectfully submitted that the Lopatin et al. reference fails to answer the recitations of the claims in substantially the same manner. The Examiner asserts that the claim does not recite that the oxide layer 108 is directly formed on layer 116. Nevertheless, layer 116 is clearly disclosed only as an oxide layer but not a flowable oxide layer and, moreover, it appears physically impossible to form a primary protective layer by oxidizing an oxide layer (which, in the absence of disclosure such as the definition of flowable oxide in the present disclosure, would ordinarily be understood to be fully oxidized SiO_2) particularly when physically separated therefrom by another intervening layer. The Examiner does not assert that the other references relied upon supplement Kawanoue et al. and/or Lopatin et al. on this point.

However, in order to expedite the prosecution of the application and to "structurally distinguish" the flowable oxide claimed from the silicon oxide of Kawanoue et al., claims 27 and 38 have been amended, above, to recite that the flowable oxide has a lower dielectric constant than SiO_2. It is disclosed at least on page 2 that flowable oxides are a family of materials having a low dielectric constant and at least on page 12 that the dielectric constant of flowable oxide is increased when it is oxidized, as claimed. Therefore, the claims clearly exclude silicon oxide as possibly being considered to be a material which can answer the language "flowable oxide". Accordingly, it is respectfully submitted that the claims have been fully and patentably distinguished from the Kawanoue et al. and Lopatin et al. references and that the Examiner's clearly erroneous assertions concerning "flowable oxide" are even more untenable. Thus

reconsideration and withdrawal of the grounds of rejection of claims 27 - 33 and 36 - 48 are clearly in order and respectfully requested.

Since all rejections, objections and requirements contained in the outstanding official action have been fully answered and shown to be in error and/or inapplicable to the present claims, it is respectfully submitted that reconsideration is now in order under the provisions of 37 C.F.R. §1.111(b) and such reconsideration is respectfully requested. Upon reconsideration, it is also respectfully submitted that this application is in condition for allowance and such action is therefore respectfully requested.

If an extension of time is required for this response to be considered as being timely filed, a conditional petition is hereby made for such extension of time. Please charge any deficiencies in fees and credit any overpayment of fees to Deposit Account No. 09-0458 of International Business Machines Corporation (E. Fishkill).

Respectfully submitted,

Marshall M. Curtis
Reg. No. 33,138

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PATENT TRADEMARK OFFICE

APPENDIX

Claims 27 and 38:

27. (Twice Amended) An integrated circuit semiconductor device including

a substrate having a substrate surface,

a flowable oxide (FOX) insulator [(FOX)] layer formed of a flowable oxide material having a lower dielectric constant than SiO_2 upon said substrate surface,

a trough in said flowable oxide insulator layer[,] having sidewalls of said flowable oxide [insulator layer] material,

a primary protective layer on said sidewalls of said flowable oxide insulator layer, said primary protective layer being a thin oxidized surface layer of said [FOX] flowable oxide insulator material on said sidewalls within said trough, said thin surface layer preventing the exposure of said flowable oxide insulator layer to moisture and lithographic resist developers, said primary protective layer being substantially impervious to copper extrusion, and

a secondary protective layer on said primary protective layer and on said substrate surface, said secondary protective layer being electrically conductive.

38. (Amended) An integrated circuit including

a layer of flowable oxide insulator of a flowable oxide material having a dielectric constant lower than SiO_2, and

a thin protective layer thereon, said thin protective layer being an oxidized surface layer of said flowable oxide insulator that is resistant to moisture and lithographic resist developers.